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Tropical Cyclone Exposures and Health: A New Data Set to Assess Associations over Time

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When a tropical cyclone strikes a region, some deaths and injuries may be directly tied to the storm. Drownings may be caused by flooding, and crushing injuries can result from high winds. However, disasters may also impact health through less apparent routes. For example, the psychological stress of losing one's home could trigger a heart attack in a person with traditional cardiovascular risk factors, says Brooke Anderson, an associate professor of epidemiology at Colorado State University. In a recent paper published in *Environmental Health Perspectives*, Anderson and colleagues presented an open-source data set to help epidemiologists understand the health risks associated with tropical cyclones across the eastern half of the United States.[1]

Forecasting technologies developed over the last several decades have led to better warning and evacuation systems. These systems have dramatically lowered deaths and injuries from direct causes when a terrible storm hits, Anderson says. "What's been harder to study is how those disasters might affect health through an indirect path, especially when looking at health outcomes—such as a heart attack—that are pretty common outside of the storm," she says.

Some investigators have already begun to study the indirect health impacts of specific tropical cyclones, including Hurricane Maria,[2] which struck Puerto Rico and several Caribbean islands in 2017, and Hurricane Sandy,[3] which caused damage in the Caribbean and along the U.S. and Canadian coasts in 2012. Similar data sets have been developed for heat waves to compare how community-wide rates of health outcomes change during or after a heat event.[4] "We know a fraction of the health impacts of single large hurricanes," says Marianthi-Anna Kioumourtzoglou, an epidemiologist at Columbia University, "[but] what is the impact on the health of the cumulative exposure to smaller storms for people living in coastal communities?" Kioumourtzoglou was not involved in the study.

To create the new cyclone-specific data set, Anderson and colleagues compiled county-level exposure data for four tropical cyclone hazards: peak sustained wind, rainfall, flooding, and tornadoes. The data cover all counties in the eastern half of the United States for all land-falling or near-land Atlantic basin storms between 1988 and 2018. The researchers chose to aggregate exposure data at the county level to facilitate joining them

A new open-source data set will help epidemiologists better estimate excess mortality and morbidity related to cyclone-related hazards, including flooding, high winds, heavy rains, and tornadoes. Image: © iStockphoto/Shmenny50.

with other county-level health data such as deaths, hospitalizations, and birth outcomes. The county level is also where decisions and policies around disaster preparation and response are often undertaken.

As part of a separate research team, Anderson used the open-source package to assess whether tropical cyclone exposures are linked to adverse birth outcomes[5] and is currently studying hospitalization risk among the elderly. Kioumourtzoglou is using the data set to study whether health outcomes such as hospitalizations for asthma attacks, heart attacks, or infections go up or down with exposure to tropical cyclone hazards. "There is the potential to take tropical cyclone epidemiology in a powerful new direction," Kioumourtzoglou says.

Yet, there are certain limitations. Some tropical cyclone exposures may be more consistent over large areas than others.[6] High winds and rainfall totals, for instance, may be consistent across a county, tornadoes or flooding may be much more localized.[1] If a county is very large, maybe only one part of it experiences flooding. Maybe houses in only a few neighborhoods are destroyed by a tornado. "This could lead to issues with exposure misclassification," Kioumourtzoglou says.

This type of big data approach also may not fully account for social vulnerability, says Jennifer Horney, a disaster epidemiologist at the University of Delaware who was not involved in the study. She explains that factors such as people's housing, their ability to understand warnings and alerts, and access to vehicles should be part of the equation. "Even at the county level," she says, "disasters impact different groups differently."

Lindsey Konkel is a New Jersey–based journalist who reports on science, health, and the environment.

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